

Engineering Design File

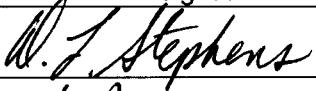
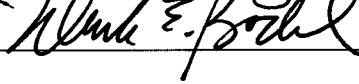
V-9 Tank Macroencapsulation and Lifting Design

Structural Analysis and Lift Plan

**Idaho
Cleanup
Project**

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EDF No.: 6306 EDF Rev. No.: 0 Project File No.: 22901

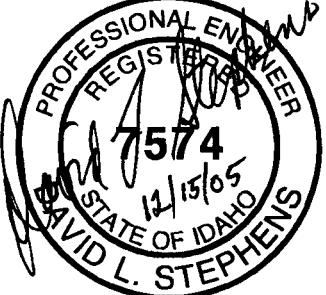
1. Title: <u>V-9 Tank Macroencapsulation and Lift Design Structural Analysis and Lift Plan</u>				
2. Index Codes: Building/Type <u>N/A</u> SSC ID <u>V-9 Tank</u> Site Area <u>034 (TAN)</u>				
3. NPH Performance Category: _____ or <input checked="" type="checkbox"/> N/A				
4. EDF Safety Category: <u>CG</u> or <input type="checkbox"/> N/A SCC Safety Category: <u>CG</u> or <input type="checkbox"/> N/A				
5. Summary: <p>This EDF documents the structural analysis of the proposed design to encapsulate the V-9 tank prior to transport and disposal of the tank at the ICDF near INTEC. Also included is an evaluation of 1) the strength of the weld at the top flange for use in lifting the tank empty in a double choker configuration and 2) an evaluation of the proposed lifting lug design for use in lifting the fully grouted and concrete encapsulated tank. A lift plan sketch is included for each of two lifts.</p> <p>The conclusion of this analysis is that the proposed design shown on the drawings in Appendix D is adequate for the macroencapsulation of the the V-9 tank. Also, the V-9 tank flange weld and lifting lugs have a minimum 3:1 safety factor (on yield), for the loads acting during each lift. The lift plan sketches included herein are intended for use in the final lift plan documentation.</p>				
6. Review (R) and Approval (A) and Acceptance (Ac) Signatures: (See instructions for definitions of terms and significance of signatures.)				
	R/A	Typed Name/Organization	Signature	Date
Performer/ Author	A	D. L. Stephens, P. E./5311		<u>12/15/05</u>
Checker	R	N. K. Rogers, P. E./5311		<u>12/16/05</u>
EGS Reviewer	R	K. D. Fritz, P.E./5311		<u>12/16/05</u>
Project Engineer	Ac	M. E. Bodily, P. E./5311		<u>12-16-05</u>
Doc. Control	EROB	<u>M. Jacqueline Keele</u>		<u>12/22/05</u>
7. Distribution: (Name and Mail Stop)		<u>D. L. Stephens, MS 3650</u>		
8. Does document contain sensitive unclassified information? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If Yes, what category:				
9. Can document be externally distributed? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				
10. Uniform File Code: <u>6102</u>		Disposition Authority: <u>ENV1-h-1</u>		
Record Retention Period: See LST-9				
11. For QA Records Classification Only: <input type="checkbox"/> Lifetime <input checked="" type="checkbox"/> Nonpermanent <input type="checkbox"/> Permanent Item and activity to which the QA Record apply: <u>V-9 Tank Macroencapsulation</u>				
12. NRC related? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No				

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01/30/2003
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Structural Analysis and Lift Plan

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1. Title:	V-9 Tank Macroencapsulation and Lift Design Structural Analysis and Lift Plan		
2. Index Codes:			
Building/Type	N/A	SSC ID	V-9 Tank
Site Area 034 (TAN)			
13. Registered Professional Engineer's Stamp (if required)			
			

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1. PURPOSE

The purpose of this Engineering Design File (EDF) is to verify the structural adequacy of the V-9 tank flange for initial lifting and also to document the structural evaluation of key elements of the macroencapsulation design. The design involves placement of the tank into a large diameter corrugated metal pipe culvert, filling the tank with a controlled low-strength material (CLSM), and then encasing the tank with reinforced concrete. Lifting lugs are to be embedded in the concrete by which the entire assembly will be lifted and also used for tie-downs for transport to the ICDF.

2. SCOPE

This EDF contains calculations that determine the following:

1. The weight of the empty tank, the weight of the tank full of CLSM with density 110 lb/ft, the weight of the entire pipe culvert assembly with tank full of CLSM and pipe culvert full of concrete.
2. Weld adequacy along the V-9 Tank top flange for lifting the tank empty.
3. Structural adequacy of the bottom support ring and base plate to support the V-9 Tank full of CLSM.
4. Structural adequacy of the corrugated pipe culvert for fresh concrete pressure loads on the wall of the culvert.
5. Structural adequacy of the lifting lugs for lifting the entire grouted and macroencapsulated tank and pipe culvert assembly.

3. SAFETY CATEGORY

The activities contained within this EDF are classified as Consumer Grade (CG). All design and construction will comply with the quality requirements specified for this level of safety category.

4. NATURAL PHENOMENA HAZARDS PERFORMANCE CATEGORY

A natural phenomena hazard category is not applicable to this evaluation. The structure does not allow occupancy and further, the temporary nature of its use does not justify consideration of natural phenomena hazard loads.

5. STRUCTURE SYSTEM OR COMPONENT DESCRIPTION

The V-9 is to be substantially emptied, excavated, filled with CLSM, and disposed of at ICDF. In addition to being filled with CLSM, the tank, prior to transport, is to be encapsulated with concrete. This will be accomplished by placing the tank (approximate size is 3'-6" ft dia. x 7'-6" high) into a standard corrugated metal pipe culvert (size 6 ft dia. x 10 ft high), filling the tank with CLSM, and then filling the annular space and the area above and below the tank with concrete. Steel reinforcement is added to the annular space to help tie the concrete together. Heavy duty lifting lugs are embedded in the concrete to facilitate lifting the entire assembly onto a transport vehicle.

6. ASSUMPTIONS

Assumptions are listed in the body of the attached calculations.

7. ACCEPTANCE CRITERIA

Acceptance criteria shall be in accordance with the IBC and the DOE-ID A/E Standards including their referenced codes/standards.

8. CONCLUSIONS/RESULTS

All key components of the pipe culvert assembly are structurally adequate for the design load combinations considered herein.

9. REFERENCES

1. AISC Manual of Steel Construction - Allowable Stress Design, 9th edition, 1989
2. AISC Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design, June 1989
3. ASTM A 760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
4. ASTM A 796, Standard Practice for Structural Design of Corrugated Steel Pipe, Pipe-Arches, and Arches for Storm and Sanitary Sewers and Other Buried Applications
5. STD-116, DOE-ID Architectural Engineering Standards, Rev. 31, U.S. Department of Energy Idaho Operations Office, 2005
6. IBC, 2003, "International Building Code," International Conference of Building Officials
7. STAAD.Pro 2004, Research Engineers International, Yorba Linda, California
8. INL Drawings 634826 and 634827
9. Handbook of Steel Drainage and Highway Construction Products, American Iron and Steel Institute, 1983

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APPENDIX A

Calculations and Discussion of Results

V-9 Tank Calculations (see Appendix C for sketch of tank)

Tank dead loads:

$$t := 0.25 \text{ in} \quad h_{\text{cone}} := 21 \cdot \text{in} \quad h_{\text{shell}} := 5.5 \cdot \text{ft} \quad r_o := 21 \cdot \text{in} \quad r_i := r_o - 2 \cdot (t) \quad \gamma_{\text{steel}} := 490 \frac{\text{lbf}}{\text{ft}^3}$$

$$D_{\text{top}} := 53 \cdot \text{in}$$

$$W_{\text{cone}} := \frac{1}{3} \cdot \pi \cdot h_{\text{cone}} \cdot (r_o^2 - r_i^2) \cdot \gamma_{\text{steel}} \quad W_{\text{cone}} = 129 \text{lbf}$$

$$W_{\text{shell}} := \frac{\pi}{4} \cdot h_{\text{shell}} \cdot (2r_o^2 - 2r_i^2) \cdot \gamma_{\text{steel}} \quad W_{\text{shell}} = 610 \text{lbf}$$

$$W_{\text{top}} := \frac{\pi \cdot D_{\text{top}}^2}{4} \cdot t \cdot \gamma_{\text{steel}} \quad W_{\text{top}} = 156 \text{lbf}$$

$$W_{\text{misc}} := 500 \text{lbf} \quad (\text{estimated weight for 4 nozzles, tee, top flange, and internal baffle})$$

$$W_{\text{empty}} := W_{\text{cone}} + W_{\text{shell}} + W_{\text{top}} + W_{\text{misc}} \quad W_{\text{empty}} = 1396 \text{lbf}$$

Weight of tank contents when full of grout:

$$V_{\text{cone}} := \frac{1}{3} \pi \cdot h_{\text{cone}} \cdot r_i^2 \quad V_{\text{cone}} = 5.35 \text{ ft}^3$$

$$V_{\text{shell}} := \frac{\pi}{4} \cdot h_{\text{shell}} \cdot [2 \cdot (r_i)]^2 \quad V_{\text{shell}} = 50.43 \text{ ft}^3$$

$$V_{\text{full}} := V_{\text{cone}} + V_{\text{shell}} \quad V_{\text{full}} = 55.8 \text{ ft}^3$$

$$W_{\text{cgrount}} := V_{\text{full}} \cdot 110 \frac{\text{lbf}}{\text{ft}^3} \quad W_{\text{cgrount}} = 6135 \text{lbf}$$

$$\text{Total tank weight (final lift):} \quad W_{\text{final}} := W_{\text{empty}} + W_{\text{cgrount}} \quad W_{\text{final}} = 7531 \text{lbf}$$

Shear stress on 1/4" fillet weld at flange

Double choker sling configuration is assumed to place vertical shear stress equally around entire perimeter of fillet weld (tank outside diameter 3'-6", shell thickness 1/4"):

$$\text{width}_{\text{eff}} := 0.25 \text{ in} \cdot 0.707 \quad \text{width}_{\text{eff}} = 0.177 \text{ in}$$

$$D_o := 3 \cdot \text{ft} + 6 \cdot \text{in} + 2 \cdot \text{width}_{\text{eff}} \quad D_i := 3 \cdot \text{ft} + 6 \cdot \text{in}$$

$$A_o := \frac{\pi D_o^2}{4} \quad A_i := \frac{\pi D_i^2}{4}$$

$$A_{\text{weld}} := A_o - A_i \quad A_{\text{weld}} = 23.4 \text{ in}^2$$

$$f_y := \frac{W_{\text{empty}}}{A_{\text{weld}}} \quad f_y = 60 \text{ psi}$$

$$\text{Allowable stress on weld (assuming E70 fillet weld):} \quad f_a := (0.3) \cdot 70 \text{ ksi}$$

Factor of safety on weld capacity of top flange when lifted empty:

$$FS := \frac{f_a}{f_y} \quad FS = 352 \quad (\text{if tank has a small amount of liquid waste remaining the weld strength is still adequate})$$

Calculate total weight for final lift:

$$r_{\text{ipipe}} := 37 \cdot \text{in} \quad (\text{internal radius of pipe is 1" larger than nominal to account for corrugations, this is conservative})$$

$$h_{\text{pipe}} := 10 \cdot \text{ft} \quad \gamma_{\text{conc}} := 150 \frac{\text{lbf}}{\text{ft}^3}$$

$$V_{\text{cylinder}} := \pi \cdot r_{\text{ipipe}}^2 \cdot h_{\text{pipe}} \quad V_{\text{cylinder}} = 299 \text{ ft}^3$$

$$W_{\text{pipe}} := h_{\text{pipe}} \cdot \left(110 \frac{\text{lbf}}{\text{ft}} \right) \quad W_{\text{pipe}} = 1100 \text{ lbf} \quad (\text{See Appendix C})$$

$$W_{\text{concrete}} := (V_{\text{cylinder}} - V_{\text{full}}) \cdot \gamma_{\text{conc}} \quad W_{\text{concrete}} = 36434 \text{ lbf}$$

Miscellaneous weight includes the weight of the bottom plate (6.5 ft x 6.5 ft x 1/2 in. thick), bottom support ring, the rebar cage (assume 500 lbs), four lifting lugs (400 lbs), and misc steel (500 lbs).

$$W_{\text{misc}} := 0.5 \text{ in} \cdot (6.5 \text{ ft})^2 \cdot \gamma_{\text{steel}} + \frac{\pi}{4} \cdot 29 \text{ in} \cdot [36 \text{ (in)}]^2 - [35.25 \text{ (in)}]^2 \cdot \gamma_{\text{steel}} + 1400 \text{ lbf}$$

$$W_{\text{misc}} = 2608 \text{ lbf}$$

$$W_{\text{final}} := W_{\text{final}} + W_{\text{concrete}} + W_{\text{pipe}} + W_{\text{misc}} \quad W_{\text{final}} = 47673 \text{ lbf}$$

$$W_{\text{final}} = 48 \text{ kip}$$

Distribution of load around bottom support ring:

$$P_{\text{ring}} := 2 \cdot \pi \cdot \frac{35.25}{2} \cdot \text{in} \quad P_{\text{ring}} = 9 \text{ ft}$$

$$w_{\text{load}} := \frac{W_{\text{final}}}{P_{\text{ring}}} \quad w_{\text{load}} = 5166 \frac{\text{lbf}}{\text{ft}}$$

$$\text{horizontal and vertical components:} \quad w_{xy} := 0.707 w_{\text{load}} \quad w_{xy} = 3652 \frac{\text{lbf}}{\text{ft}}$$

$$\text{Horizontal Distribution to each node:} \quad w_{nxy} := 3.14 \text{ in} \cdot w_{xy} \quad w_{nxy} = 956 \text{ lbf}$$

Since STADD.Pro only allows application of a pressure in a radial direction, thus, over a top element area of 3.14 in. x 2.9 in.:

$$\text{distw}_{nxy} := \frac{w_{nxy}}{3.14 \text{ in} \cdot 2.9 \text{ in}} \quad \text{distw}_{nxy} = 105 \text{ psi}$$

Maximum pressure on compacted gravel pad (conservatively consider only area under pipe culvert):

$$w_{\text{maxbearing}} := \frac{W_{\text{final}}}{\pi \cdot \frac{[72 \cdot (\text{in})]^2}{4}} \quad w_{\text{maxbearing}} = 1686 \text{ psf} \quad < \quad 3000 \text{ psf} \quad \text{OK}$$

(3000 psf is the assumed minimum soil bearing capacity at the surface of either undisturbed granular soil or compacted pit run gravel pad)

Discussion of Results

1. The weight of the empty tank is 1,396 lbs. The weight of the tank full of CLSM is 7,531 lbs. The weight of the entire final assembly is 47,673 lbs (say 48 kips).
2. The weld around the top flange of the V-9 Tank is adequate for lifting the tank empty (or with a small amount of liquid and/or miscellaneous solid waste remaining in the tank). The factor of safety on the weld when the tank is empty is very large (>300).
3. The bottom support ring and base plate to support the V-9 Tank full of grout is adequate as shown in the analysis results shown on page 16. The maximum Von Mises stress is approximately 11.2 ksi . This is well below the allowable yield stress of 36 ksi.
4. The corrugated pipe culvert loaded with 1,500 psf (150 pcf x 10 ft) maximum fluid pressure at the base (pressure varies linearly along the 10 ft high culvert from 1500 psf at the base to 0 psf at the top) produces a maximum hoop stress of 3,440 psi as shown in the calculations below.

$$S := \frac{P \cdot D}{2 \cdot t}$$

where:

S= hoop stress

P= internal pressure

D= outside diameter of the pipe

t= wall thickness

$$P := 1500 \text{ psf}$$

$$D := 72 \cdot \text{in}$$

$$t := 0.109 \text{ in}$$

$$S := \frac{P \cdot D}{2 \cdot t} \quad S = 3440 \text{ psi}$$

Allowable wall stress for steel corrugated pipe under compressive loads can be taken as at least 19,000 psi (Ref. 9, page 3-6). This value (factor of safety of 2.0) is also taken as the allowable wall stress for steel corrugated pipe under tensile load. This is conservative. The maximum hoop stress of 3,440 psi, therefore, represents a safety factor of 5.5 against steel wall failure.

If seams are longitudinal (riveted or spot welded) the ultimate seam strength is 53,000 lbs per ft of seam (Ref 4). This compares to 4,500 lbs of actual hoop force per ft of seam (3,440 psi x 0.109 in x 12 in). Thus, seam strength is **OK**.

If seams are helical (continuous welded seams) the seam strength develops the full strength of the pipe (Ref. 3, Section 7.6). Thus, helical seams also **OK** since pipe wall is **OK**.

5. The lifting lugs are adequate for a load of 24 kips per lifting lug (half of total load assumed possible to be taken by each lug). Analysis results are shown on pages 21-22. The maximum Von Mises stress is approximately 18.4 ksi. This is well below the allowable yield stress of 36 ksi. Due to modeling limitations and the manner in which loads are placed, the maximum stress of 18.4 ksi is likely a stress concentration and is not representative of the actual maximum stress. A more representative value of the maximum stress can be taken at a distance of approximately 0.5 inch from the maximum stress. From page 22 this average maximum Von Mises stress is seen to be approximately 12 ksi. This reflects a factor of safety of 3:1 on the yield stress of 36 ksi.

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APPENDIX B

STAAD.Pro 2004 Input and Output



STAAD.Pro Report

To:

From:

Copy to:

Date:

15/12/2005

Ref:

ca/ Document1

12:40:00

Job Information

	Engineer	Checked	Approved
--	-----------------	----------------	-----------------

Name:
Date: 25-Oct-05

Structure Type SPACE FRAME

Number of Nodes	785	Highest Node	785
Number of Plates	1152	Highest Plate	1182

Number of Basic Load Cases	2
Number of Combination Load Cases	1

*Included in this printout are data for:
All The Whole Structure*

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	DEAD LOAD
Primary	2	GROUT PRESSURE LOAD
Combination	3	LOAD COMBINATION

Plate Thickness

Prop	Node A (in)	Node B (in)	Node C (in)	Node D (in)	Material
1	0.375	0.375	0.375	0.375	STEEL
2	0.500	0.500	0.500	0.500	STEEL

Materials

Mat	Name	E (kip/in ²)	v	Density (kip/in ³)	α (1/K)
3	STEEL	29E 3	0.300	0.000	3.61E -6
4	ALUMINUM	10E 3	0.330	0.000	7.11E -6
5	CONCRETE	3.15E 3	0.170	0.000	3.06E -6

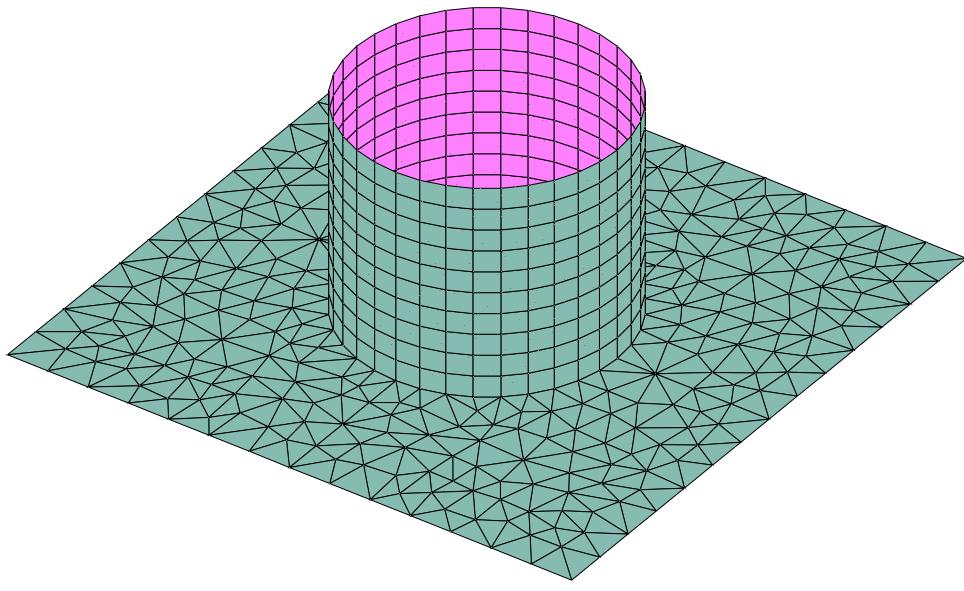
Basic Load Cases

Number	Name
--------	------

1 DEAD LOAD
2 GROUT PRESSURE LOAD

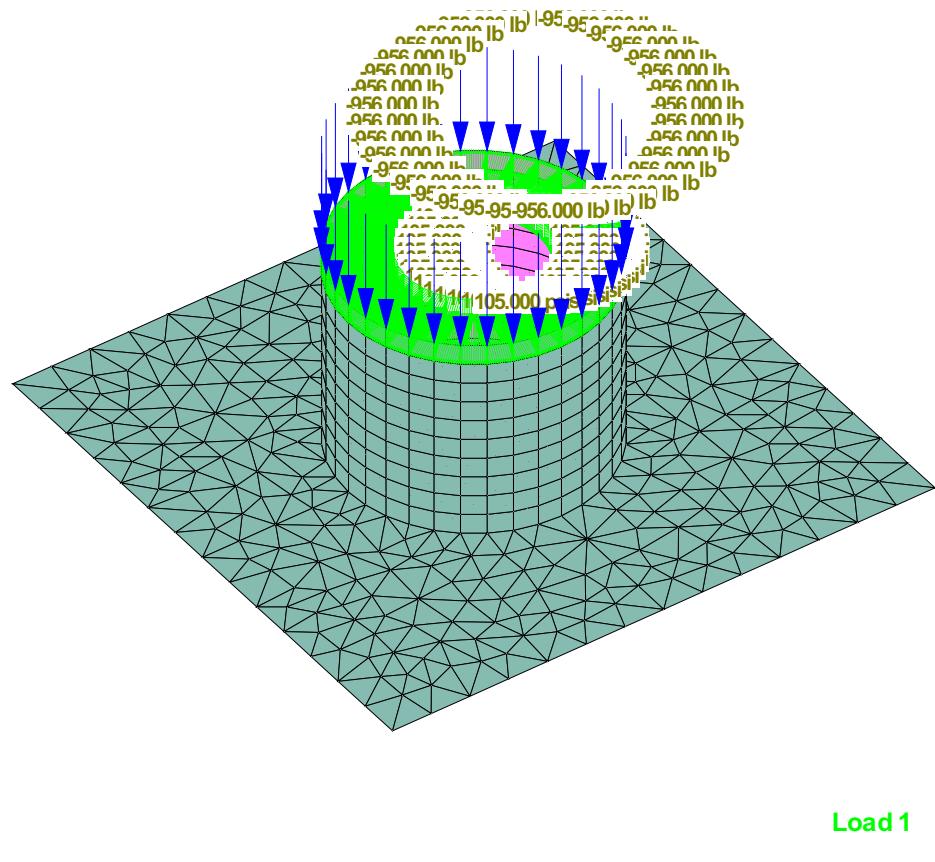
Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
3	LOAD COMBINATION	1	DEAD LOAD	1.00
		2	GROUT PRESSURE LOAD	1.00



Load 1

Isometric View - Geometry



Isometric View - Dead Load from Grout Filled V-9 Tank (vertical and horizontal components)

M a x V o n M i s
k s i

< = 0 . 2 6 0

■ 0 . 9 4 2

■ 1 . 6 3

■ 2 . 3 1

■ 2 . 9 9

■ 3 . 6 7

■ 4 . 3 6

■ 5 . 0 4

■ 5 . 7 2

■ 6 . 4 1

■ 7 . 0 9

■ 7 . 7 7

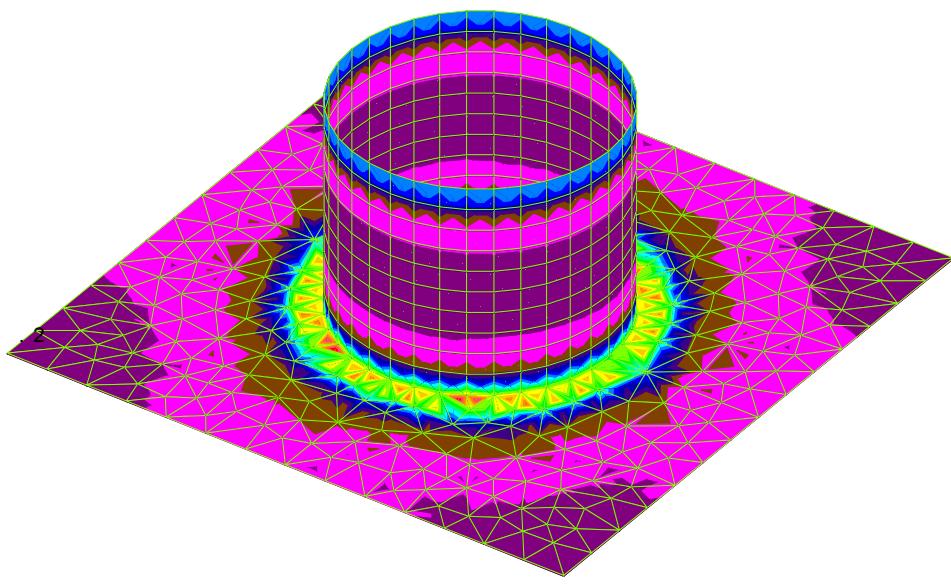
■ 8 . 4 5

■ 9 . 1 4

■ 9 . 8 2

■ 1 0 . 5

■ > = 1 1 . 2



Load 3 : Displacement

Isometric View - Maximum Von Mises Stress



STAAD.Pro Report

To: _____
From: _____
Copy to: _____ Date: 15/12/2005 Ref: ca/ Document1
12:19:00

Job Information

	Engineer	Checked	Approved
Name:			
Date:	10-Oct-05		
Structure Type	SPACE FRAME		
Number of Nodes	142	Highest Node	142
Number of Plates	160	Highest Plate	236
Number of Basic Load Cases		1	
Number of Combination Load Cases		0	

Included in this printout are data for:
All The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	LIFTING LOAD

Plate Thickness

Prop	Node A (in)	Node B (in)	Node C (in)	Node D (in)	Material
1	1.500	1.500	1.500	1.500	STEEL

Materials

Mat	Name	E (kip/in ²)	v	Density (kip/in ³)	α (1/°K)
3	STEEL	29E 3	0.300	0.000	3.61E -6
4	ALUMINUM	10E 3	0.330	0.000	7.11E -6
5	CONCRETE	3.15E 3	0.170	0.000	3.06E -6

Supports

Node	X (kip/in)	Y (kip/in)	Z (kip/in)	rX (kip·ft/deg)	rY (kip·ft/deg)	rZ (kip·ft/deg)
1	Fixed	Fixed	Fixed	-	-	-
2	Fixed	Fixed	Fixed	-	-	-
3	Fixed	Fixed	Fixed	-	-	-
4	Fixed	Fixed	Fixed	-	-	-
23	Fixed	Fixed	Fixed	-	-	-
27	Fixed	Fixed	Fixed	-	-	-
59	Fixed	Fixed	Fixed	-	-	-
63	Fixed	Fixed	Fixed	-	-	-
82	Fixed	Fixed	Fixed	-	-	-
83	Fixed	Fixed	Fixed	-	-	-
84	Fixed	Fixed	Fixed	-	-	-
96	Fixed	Fixed	Fixed	-	-	-
97	Fixed	Fixed	Fixed	-	-	-
98	Fixed	Fixed	Fixed	-	-	-

Basic Load Cases

Number	Name
1	LIFTING LOAD

Combination Load Cases

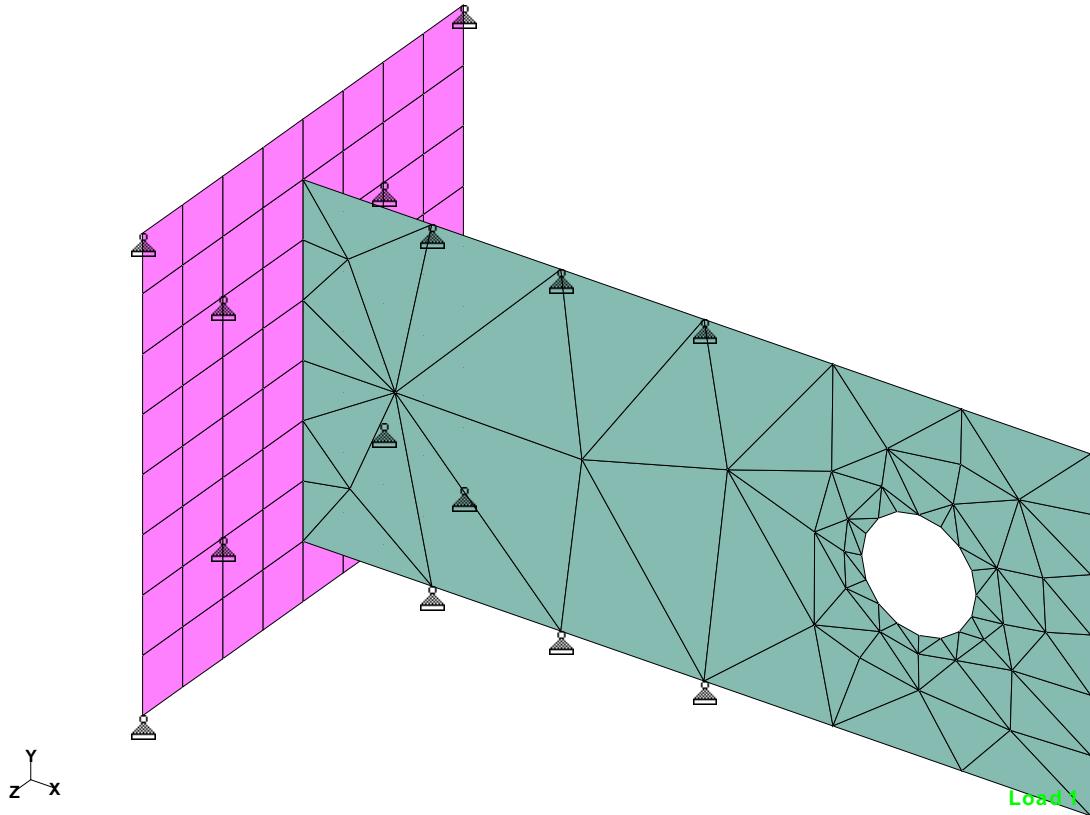
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Load Generators

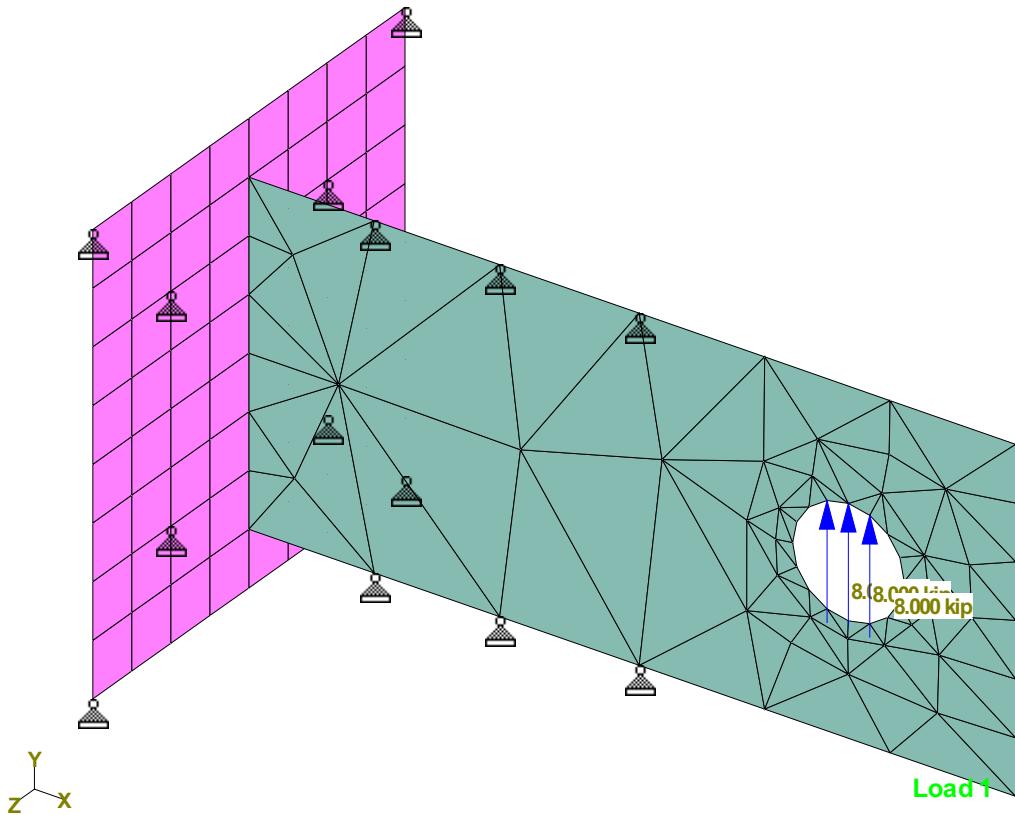
There is no data of this type.

Node Loads : 1 LIFTING LOAD

Node	FX (kip)	FY (kip)	FZ (kip)	MX (kip·ft)	MY (kip·ft)	MZ (kip·ft)
102	-	8	-	-	-	-
103	-	8	-	-	-	-
104	-	8	-	-	-	-



Isometric View - Model Geometry



Isometric View - Lifting Load of 24 kips total

M a x V o n M i s
k s i

< = 0 . 0 0 8

■ 1 . 1 6

■ 2 . 3

■ 3 . 4 5

■ 4 . 6

■ 5 . 7 5

■ 6 . 9

■ 8 . 0 4

■ 9 . 1 9

■ 1 0 . 3

■ 1 1 . 5

■ 1 2 . 6

■ 1 3 . 8

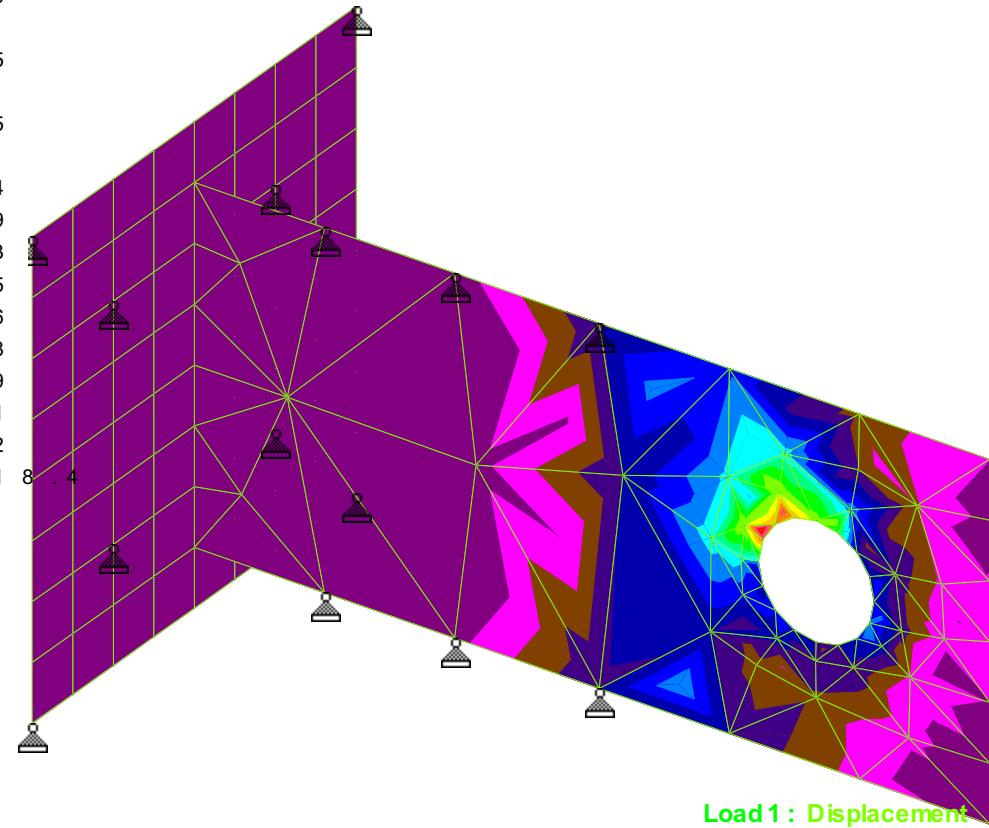
■ 1 4 . 9

■ 1 6 . 1

■ 1 7 . 2

> = 1 8 . 4





Isometric View - Maximum Von Mises Stress

M a x V o n M i s
k s i

< = 0 . 0 0 8

■ 1 . 1 6

■ 2 . 3

■ 3 . 4 5

■ 4 . 6

■ 5 . 7 5

■ 6 . 9

■ 8 . 0 4

■ 9 . 1 9

■ 1 0 . 3

■ 1 1 . 5

■ 1 2 . 6

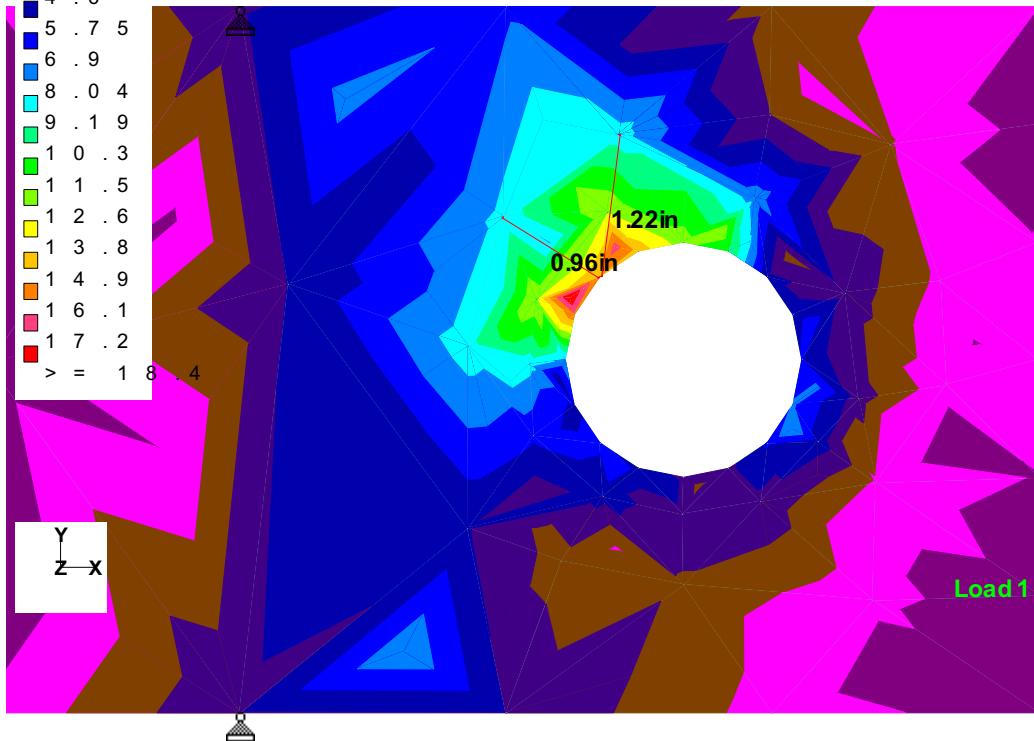
■ 1 3 . 8

■ 1 4 . 9

■ 1 6 . 1

■ 1 7 . 2

> = 1 8 . 4



Close up on Maximum Von Mises Stress

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APPENDIX C

Reference Information



THE LANE LIBRARY:

 [LANE'S PRODUCTS](#)
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[SPIRAL RIB PIPE](#)
[CORRUGATED ALUMINUM PIPE](#)
[JOINTS & ACCESSORIES](#)
[HDPE PIPE](#)
[STRUCTURAL PLATE PIPE](#)
[WELDED WIRE MESH GABIONS](#)

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[THE PRODUCT](#)
[SPECIFICATIONS](#)
[SIZES AND WEIGHTS](#)

[HYDRAULIC DESIGN DATA](#)
[MANNING'S "n"](#)
[FULL-FLOW DATA](#)

[STRUCTURAL DESIGN DATA](#)
[SECTION PROPERTIES](#)
[LOADS ON PIPE](#)
[HEIGHT OF COVER TABLES](#)
[FITTINGS REINFORCEMENT](#)

[DURABILITY DESIGN DATA](#)
[GENERAL DISCUSSION](#)
[CSP DURABILITY GUIDE](#)

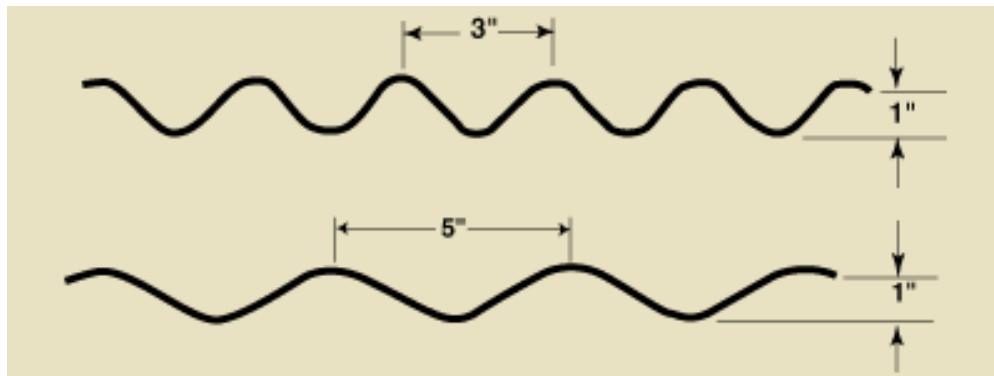
[APPLICATIONS](#)
[APPLICATION DISCUSSION](#)

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SIZES & WEIGHTS

PG 2 OF 3

3" X 1" & 5" x 1" ROUND PIPE



INSIDE DIAMETER IN INCHES	SPECIFIED THICKNESS IN INCHES	APPROXIMATE POUNDS PER LINEAR FOOT***			
		METALLIC COATED	FULL BITUMINOUS COATED	FULL BITUMINOUS COATED AND INVERT PAVED	FULL BITUMINOUS COATED AND FULL PAVED
54	0.064	50	66	84	138
	0.079	61	77	95	149
	0.109	83	100	118	171
	0.138	106	123	140	194
	0.168	129	146	163	217
60	0.064	55	73	93	153
	0.079	67	86	105	165
	0.109	92	110	130	190
	0.138	118	136	156	216
	0.168	143	161	181	241
66	0.064	60	80	102	168
	0.079	74	94	116	181
	0.109	101	121	143	208
	0.138	129	149	171	236
	0.168	157	177	199	264
72	0.064	66	88	111	183
	0.079	81	102	126	197
	0.109	110	132	156	227
	0.138	140	162	186	257
	0.168	171	193	217	288
78	0.064	71	95	121	198
	0.079	87	111	137	214
	0.109	119	143	169	246
	0.138	152	176	202	279
	0.168	185	209	235	312
84	0.064	77	102	130	213
	0.079	94	119	147	230
	0.109	128	154	182	264
	0.138	164	189	217	300
	0.168	199	224	253	335
90	0.064	82	109	140	228
	0.079	100	127	158	246
	0.109	137	164	195	283
	0.138	175	202	233	321
	0.168	213	240	271	359
96	0.064	87	116	149	242
	0.079	107	136	169	262
	0.109	147	176	209	302
	0.138	188	217	250	343
	0.168	228	257	290	383
102	0.064	93	124	158	258
	0.079	114	145	179	279
	0.109	155	189	220	320
	0.138	198	229	263	363
	0.168	241	272	306	406
108	0.064	98	131	166	273
	0.079	120	153	188	295
	0.109	165	198	233	340
	0.138	211	244	279	386
	0.168	256	289	324	431

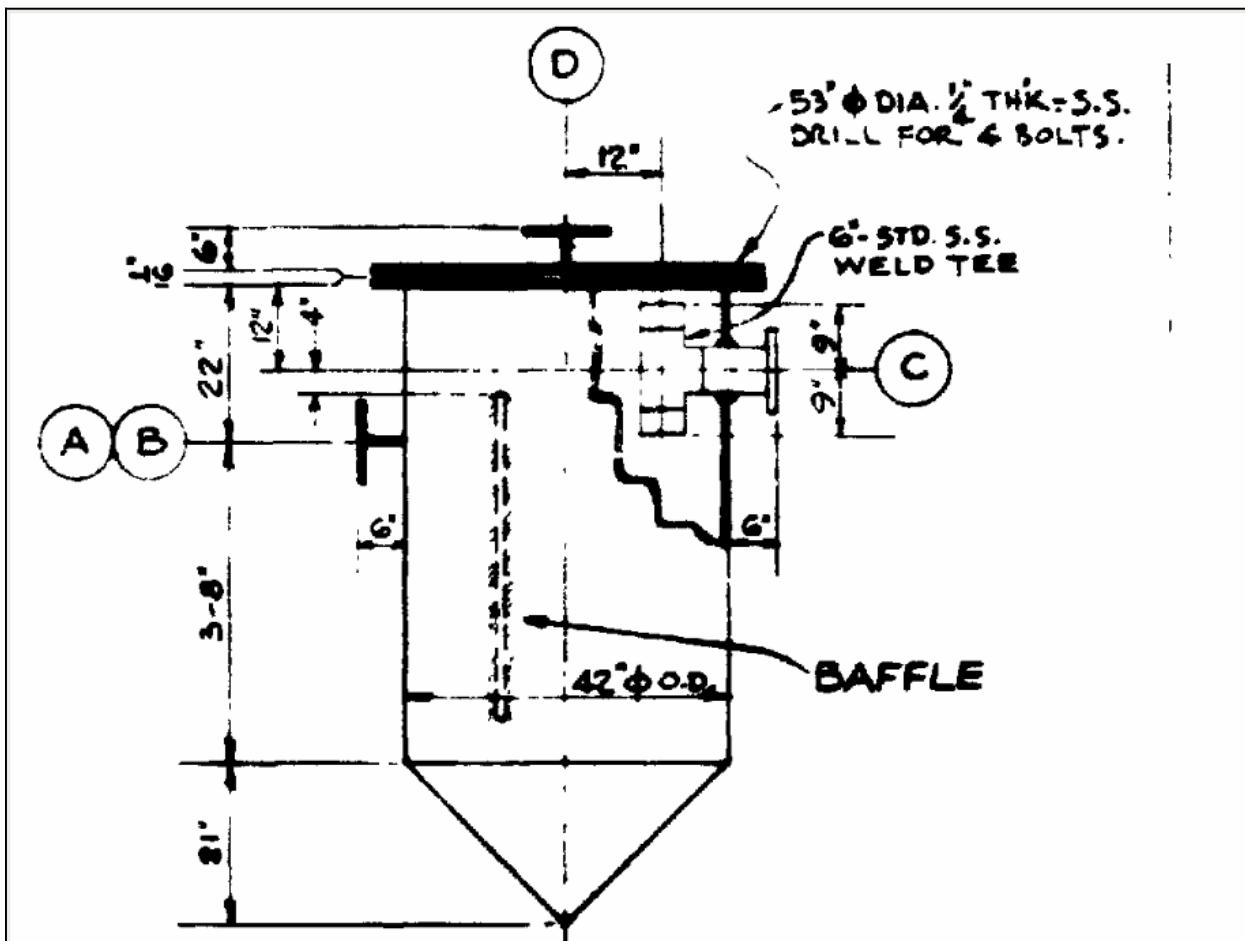
431.02
01/30/2003
Rev. 11

ENGINEERING DESIGN FILE
V-9 Tank Macroencapsulation and Lift Design
Structural Analysis and Lift Plan

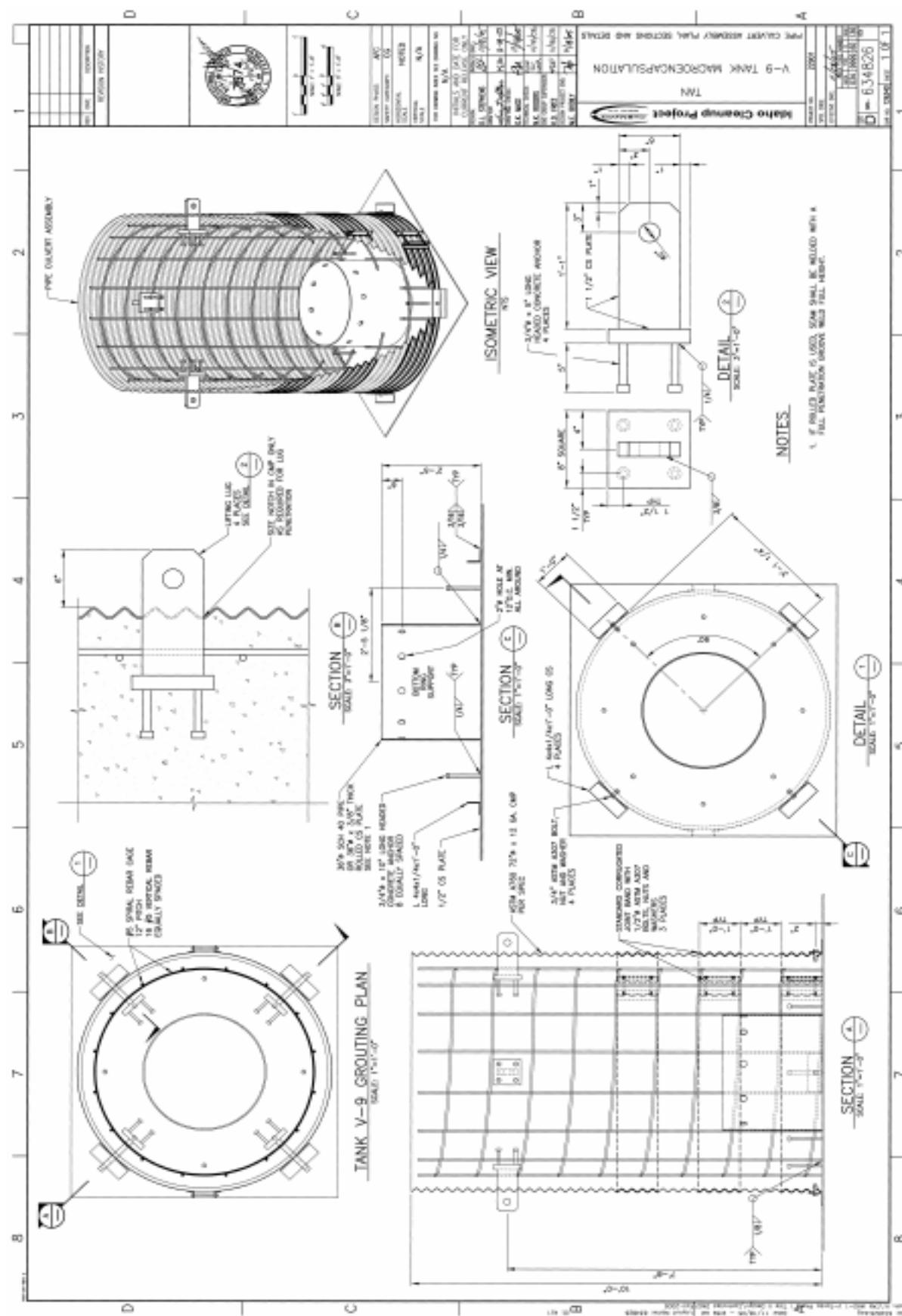
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APPENDIX D

Drawings



V-9 Tank Original Construction Detail



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Rev. 11

ENGINEERING DESIGN FILE
V-9 Tank Macroencapsulation and Lift Design
Structural Analysis and Lift Plan

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APPENDIX E

Lift Plan Sketches

SEE INSTRUCTIONS

Lift Category: Critical Lift Pre-Engineered Production Lift Personnel Lift Ordinary Lift (optional)

Appointed

Person

Phone: _____ Date: 10/26/05

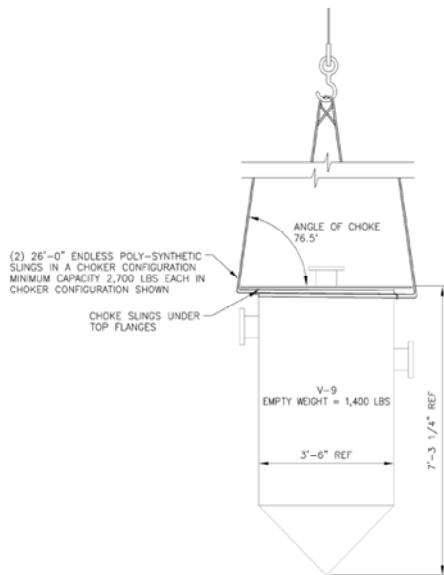
Facility: TAN

W.O./Procedures No.: _____

Index No. (optional): _____

Task: Lift Tank V-9

Rigging Configuration Sketch



Weights:

Empty Tank Weight is 1,400 lbs.

Dimensions:

As shown

Comments:

Visually inspect tank top flange and top flange weld prior to lifting. If cracks, corrosion, or other damage is present, stop the lift procedure and contact engineering for evaluation. Remove soil around tank as indicated on Drawing 628450. Use Dynamometer to verify lift.

APPROVALS

Responsible Manager
Print/Type Name

Responsible Manager
Signature

Date

Oversight Organization
Print/Type Name

Oversight Organization
Signature

Date

Appointed Person
Print/Type Name

Appointed Person
Signature

Date

SEE INSTRUCTIONS

Lift Category: Critical Lift Pre-Engineered Production Lift Personnel Lift Ordinary Lift (optional)

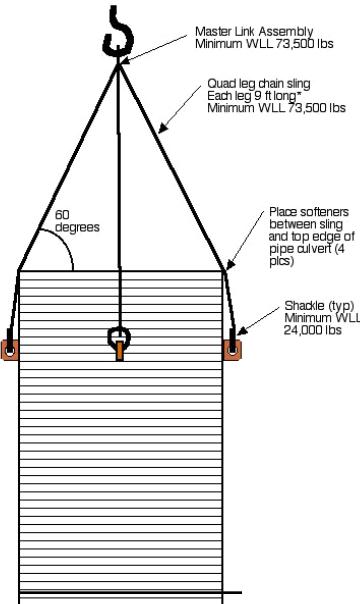
Appointed
Person

Phone: _____ Date: 10/26/05

Facility: TAN W.O./Procedures No.: _____ Index No. (optional): _____

Task: Lift Pipe Culvert Assembly containing grouted and macroencapsulated V-9 Tank

Rigging Configuration Sketch



Weights:

Total weight is 48,000 lbs.

Dimensions:
As shown

Comments:

*Place rigging such that each sling leg is loaded approximately equally throughout lift. Visually inspect lifting lugs and area immediately around lifting lugs prior to lifting. If cracks or other damage is present, stop the lift procedure and contact engineering for evaluation. Use softeners between sling legs and top edge of pipe culvert. Use Dynamometer to verify lift.

APPROVALS

Responsible Manager
Print/Type Name

Responsible Manager
Signature

Date

Oversight Organization
Print/Type Name

Oversight Organization
Signature

Date

Appointed Person
Print/Type Name

Appointed Person
Signature

Date